

Recent Developments in Surgical Skin Planing

SAMUEL AYRES, III, M.D., and J. WALTER WILSON, M.D., Los Angeles,
and RALPH LUIKART, II, M.D., Santa Barbara

- In surgical skin planing steel wire brushes have been largely replaced by the less hazardous diamond chip burs or "fraises" and serrated steel wheels.

In addition to acne pits and wrinkling, multiple actinic (senile) keratoses are an important indication for planing. Planing provides a non-scarring method for the treatment of existing keratoses, as well as a prophylaxis against skin cancer by replacing the sun-damaged, precancerous epidermis with new epidermal cells derived from the cutaneous adnexa (pilosebaceous and sweat gland units).

There are clinical landmarks indicating the depth of planing which can serve as a guide to the operator and can be correlated with microscopic findings.

The results of experiments on the compara-

tive effects of refrigerants on animal and human skin indicate that human facial skin can tolerate considerable freezing with ethyl chloride or dichlorotetrafluoroethane (Freon 114) but that mixtures containing large proportions of the much colder dichlorodifluoromethane (Freon 12) may be undesirable. Refreezing an area of the skin in order to perform a more adequate planing is not considered hazardous.

The regeneration of the skin following planing has three components: Epidermal, adnexal and dermal. The cells of the epidermis and the adnexa are equipotential. A knowledge of the anatomy of the acne pit enables the operator to decide which pits can be benefited by planing and which should be excised before planing. The successful treatment of acne pits of the face by planing in patients having keloids elsewhere on the body is reported.

FURTHER EXPERIENCE in the technique of surgical planing has led to the virtual abandonment of the steel-bristled brush because of its great coefficient of friction when compared with its cutting power and dangerous tendency to seize tissue suddenly and "gouge" deeply and uncontrollably without warning, especially at the periphery of a given area where the tissue is not frozen. The lips and eyes are zones of particular concern to the operator when using the wire brush. Gauze or hairs also become entangled frequently, resulting similarly in loss of control and occasionally breaking the flexible cable-shaft of the machine.

Two types of abrading disc have proved to be preferable. The safest is composed of a metallic disc, the periphery of which is covered with securely embedded, sharp-pointed diamond or ruby chips.⁴ These are termed *fraises* and they are available in several sizes and shapes and in varying degrees of coarseness of the chips. They are intended for cutting materials of great hardness and can withstand considerable such usage before becoming dulled. Such rugged construction is not necessary for surgical planing, but the inconvenience and cost of replacement are much less than with steel-bristled brushes, which usually become unusable after a few operations. A small pear-shaped diamond fraise is

useful around the nasolabial folds and glabella. The jeweled fraises are capable of cutting to any reasonable depth, but only in an adequately frozen area. The fine chip diamond fraises available at first were not entirely adequate for deep planing, but the recently available coarser grade is more efficient, yet retains the safety feature of almost complete freedom from gouging or catching.

A stainless steel disc with a serrated cutting edge⁴ has also been found useful for deeper cutting. These



Figure 1.—Jet-spray handpiece. The operator presses with thumb to release refrigerant spray carried from tank by plastic tubing. Area to be planed has been demarcated with gentian violet. Cotton glove is for traction. Spatter guard protects operator from abraded skin particles.

From the University of Southern California School of Medicine, Department of Dermatology, Maximilian E. Obermayer, M.D., chairman.

Presented before the section on Dermatology and Syphilology at the 86th Annual Session of the California Medical Association, Los Angeles, April 28 to May 1, 1957.

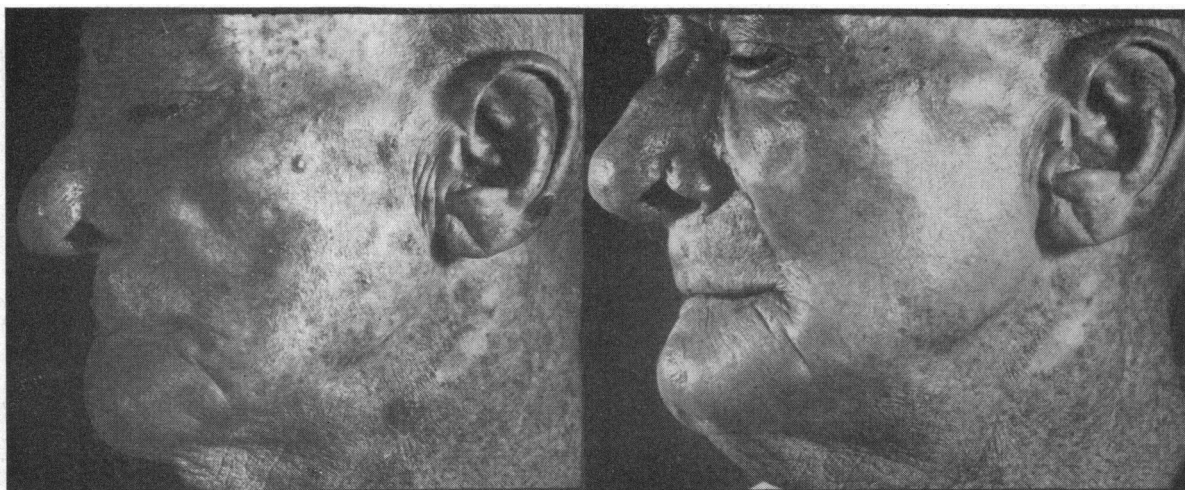


Figure 2.—*Left:* Multiple senile keratoses (farmers' or sailors' skin) before planing. *Right,* six weeks after one planing.

are available in several diameters, widths and shapes. They are not quite as free of the tendency to seize tissue and gauze as the jeweled fraises and should therefore be used with more nearly the same caution as that necessary with a bristled brush.

The jet spray handpiece previously described¹⁰ has been further improved and is obtainable (Figure 1.). Drawing its refrigerant liquid continuously from a tank containing more than needed even for a prolonged operation, it eliminates the time necessary for the operator to change from a hand-held can to the abrading tool and thus increases the convenience and efficiency of the freezing-planing procedure.

Devices to protect the operator from the spray of abraded skin particles and blood are now in general use. The jet spray handpiece has a spatter guard, and similar devices are available to clip to the conventional handpiece. Beirne and Beirne devised a guard which also serves to collect the particles of skin.¹ We have attempted to use the material collected on the spatter shield (obtained by planing nonfrozen skin) as grafts for clean granulating leg ulcers, but the results have been disappointing.

Although pitted acne scarring continues to be the major indication for planing, the value of the method in the treatment of single or multiple senile keratoses is also very great. It is a rapid method of removing the lesions adequately without producing the scarring that may result from some of the other destructive methods commonly used. It has a prophylactic effect as well, in that it replaces the epidermal cells that have been exposed to years of actinic damage with new cells derived from the adnexal structures. Thus, patients who have a hereditary predisposition toward multiple precancerous senile keratoses and skin cancer have been given, by prophylactic planing, a fresh start with a new epi-

dermis. In time, new keratoses may develop, but a substantial delaying action has been achieved. Furthermore, they have been spared the "patchwork quilt" effect that frequently results from the destruction of crops of keratoses by conventional methods over a period of years. The improved, more youthful appearance of the new skin is an extra dividend gratefully accepted (Figure 2.). In this condition, the planing should be relatively superficial, since the objective is removal of the sun-damaged epidermis. Epstein⁵ recently stressed the value of planing in the treatment of actinic and radiation keratoses,⁵ although his recommendation that it be used in chronic radiodermatitis should perhaps be qualified somewhat. We would not hesitate to plane individual radiation keratoses, but we would urge great caution in planing extensive areas of chronic radiodermatitis unless there is evidence that the cutaneous adnexa are still present. We consider planing of extensive areas that are devoid of adnexa to be contraindicated, since the normal sources for epithelial regeneration are absent.

Fine and moderate wrinkling responds well to planing (Figure 3). The more recent use of the diamond fraise with its greater safety enables one to plane quite close to the eyes without undue danger, although it is an exacting procedure.

Another situation in which planing is a useful adjunct is in bevelling the sharp edges which may result from the destruction, for example, of a basal cell carcinoma by electrodesiccation and curettage. Furthermore, one need not wait until a depressed scar has formed in order to improve it by planing but, as suggested by Zimmerman,¹⁴ freeze and plane the sharp borders immediately following the destruction of the lesion. Depressed linear traumatic scars respond well to planing (Figure 4).

Hypertrophic scars tend to recur following plan-



Figure 3.—*Left*: Moderate wrinkling (and acne pits) before planing. *Right*: Two months after one planing.

ing. Therefore, if feasible, they should be excised and sutured. If they are treated by planing, the use of x-ray may help prevent a hypertrophic recurrence.

By observation one can delineate five depths of planing which appear successively during the procedure. (Burks² wrote on depth of planing, but our observations are somewhat different from his.)

1. First the pigment vanishes, indicating that one has removed the major portion of the basal cell layer.

2. The second level is determined by observing myriads of yellowish macules, each less than one-half millimeter in diameter. This indicates that planing has progressed down into the upper dermis, making the pilosebaceous apparatus visible. Because of the shredding of dermal tissue and linear striations, this level is usually not identifiable when a wire brush is used, but it is readily seen on the much smoother abraded surface that is produced when the diamond fraise is used on a thoroughly frozen field.

3. As planing goes deeper, the surface appears studded with yellowish lobulated papules. These are the sebaceous glands which have been cut across and is the depth usually achieved in a moderately deep planing.

4. If the planing is carried deeper, decided resistance of the tissues will be encountered. This is pri-

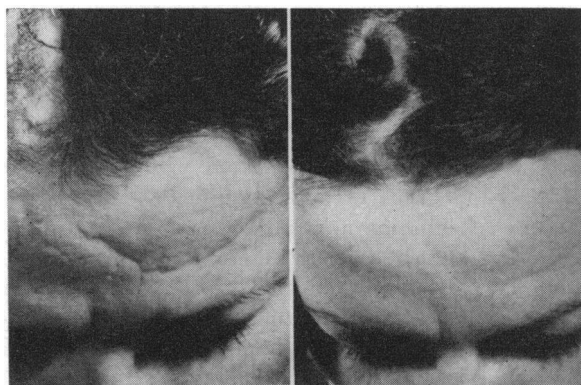


Figure 4.—Depressed linear traumatic scar. *Left*, before planing. *Right*: Six months after one planing.

marily because the tissue at that depth is below the penetration of freezing (about 2 mm.), as was pointed out by Strauss and Kligman.¹¹ Of course, if refreezing is done at this level, further depth can be achieved with relative ease, and caution is in order.

5. Finally, if planing is carried to a still greater depth, yellow "nubbins" that are lobules of subcutaneous fat are exposed. This is well below the level of the sebaceous glands and at the depth of the deepest hair papillae. Planing to this level is very



Figure 5.—Biopsy of facial skin two weeks after planing. Vellus (lanugo) hair follicles with primitive sebaceous gland buds are developing from the new epidermis. Rete ridges are still absent. Subepidermal portion of dermis appears composed of new collagen with young fibroblasts.

likely to result in removing so much adnexa as to cause scar formation.

Strauss and Kligman observed that the skin of the human cheek could be frozen for as long as 8 minutes with ethyl chloride or dichlorotetrafluoroethane (Freon 114, Frigiderm¹²) without producing severe damage, and that such reaction as did occur was no worse after 8 minutes than after one minute of application of the refrigerant.¹¹ They postulated that the great vascularity of the superficial portion of the skin prevents deep freezing and that the frozen surface itself acts as an insulator, preventing deeper penetration of the cold. In support of this, they noted that even heavily frozen skin was not frozen deeper than about 2 mm., as evidenced by the presence of freely bleeding, nonfrozen skin below this depth when planed quickly and forcefully.

In experiments we carried out with freezing the skin of the backs of dogs, significant damage was observed beginning after about one minute of application of either ethyl chloride or Freon 114 (without planing), and somewhat greater damage after one and a half and two minutes.⁹ Differences between human facial skin and that of the dog's back probably account for these quantitative differences. Dichlorodifluoromethane (Freon 12) produced damage after 15 seconds comparable to that produced by ethyl chloride or Freon 114 after one and a half or two minutes. The difference is apparently directly related to the much colder skin temperature produced by Freon 12: (Ethyl chloride, $-30^{\circ}\text{C}.$; Freon 114, $-36^{\circ}\text{C}.$; Freon 12, $-60^{\circ}\text{C}.$).

Experiments with mixtures of varying proportions of Freon 114 and the much colder Freon 12 have shown evidence of improved freezing capacity as compared with Freon 114 alone. However, we believe the proportion of Freon 12 must be kept relatively small (about 30 per cent) to avoid overfreezing, and the danger of refrigeration necrosis.¹³ For



Figure 6.—Deep acne pits. *Upper:* Before combined excision and planing. *Lower:* After excision of several of the deepest pits, followed by planing of the balance.

example, a mixture of 43 parts Freon 114 and 57 parts Freon 12 was compared with pure Freon 114 by spraying on the back of the hand for 20 seconds. The colder mixture (skin temperature $-55^{\circ}\text{C}.$) produced a considerably greater reaction than Freon 114 alone (skin temperature $-36^{\circ}\text{C}.$).

We are in complete agreement with Strauss' and Kligman's observation that refreezing an area is not harmful.¹¹ It is our belief, supported by clinical observation, that refreezing an area when necessary in order to plane it more adequately at a given session is not hazardous and is preferable to the alternative of increasing the number of planing sessions. It is often preferable to continue planing another area while waiting until bleeding has stopped in the area considered to have been inadequately planed. After a few minutes it is much easier to refreeze this area without interference from the oozing of blood.

The regeneration of the epidermis from the remaining portions of the cutaneous adnexa within a week following planing is now a familiar concept.^{3,9}

The milia which commonly occur three to six weeks after planing are actually "tiny cysts lined by stratified epithelium . . . and containing concentric lamellae of keratin."⁸ They arise from epidermal

and adnexal cells which have been isolated in the dermis at the time of planing. These cells first de-differentiate, and if they fail to rejoin the adnexa or surface epidermis, they then differentiate into milia. Moreover, the epidermal and adnexal cells are all equipotential, as evidenced by the rapid regeneration of new epidermis from every epithelial structure that remains after planing. All these specialized cells produce tongues of identical undifferentiated proliferating cells, which form a new epidermis; and from this, in turn, new vellus (lanugo) hair follicles and sebaceous glands regenerate.⁶ The sebaceous glands are first evident as primitive structures between two and four weeks after planing and are mature and functioning by two months⁶ (Figure 5).

We have been interested not only in epidermal and adnexal but also in dermal regeneration. Two weeks after planing there is a sharply defined sub-epidermal zone which is paler staining than the rest of the dermis below it. It has a loose, reticular appearance and contains many young fibroblasts, thus clearly suggesting that new collagen has been laid down during and after re-epithelization (Figure 5).

It is our experience that following a planing of moderate or greater depth there is not a restoration of dermal tissue equal in thickness to that removed; hence, the skin is actually a little thinner than before planing. However, the fact that there is at least partial restoration of the dermis seems to explain the clinical observation that even though there may be only a slight dell remaining as the bottom of a pit immediately after planing, there may be a pit of considerable depth reappearing after regeneration has occurred in a week or two. Since, in this situation, the floor of the pit with its epidermal lining has not been removed, dermal regeneration takes place on all sides of it, and the result of this particular planing session is only a partial decrease in depth of the pit. On the other hand, if the floor of this pit with its epidermal covering is completely removed by planing, then the resulting dermal regeneration will be uniform over the area, and there will be little or no evidence of the pit. The routine use of gentian violet⁷ is of great value in visualizing the depth of pits, but some pits are too deep for complete removal by planing.

It is our practice to remove, either by elliptical excision and suturing or by a punch, those pits which appear obviously too deep for safe removal by planing. This is done three or more weeks before planing, and any suture marks resulting can then be planed along with the pits (Figure 6).

Our measurements of the thickness of biopsies of facial skin showed variations between 2 mm. and 4.5 mm., the skin being thickest on the cheeks and thinnest on the anterolateral aspects of the neck and ad-

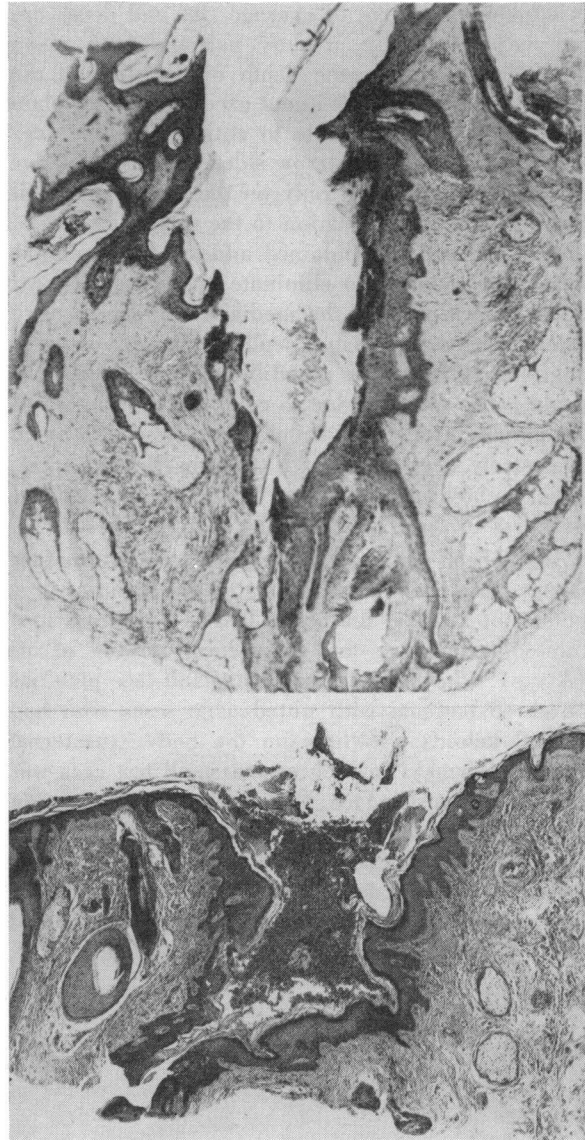


Figure 7.—Biopsies of "ice-pick" acne pits excised from bearded area of cheek of patient shown in Figure 6. *Upper:* Deep, narrow pit (2.7 mm.). *Lower:* Pit 1.8 mm. deep, with lateral extension and epidermal proliferation.

jacent to the eyes. When Strauss and Kligman performed what they considered to be very deep planing, the deepest removal of tissue was 2.0 to 2.5 mm., which is about half the total thickness of thick skin.¹¹ Their measurements and ours showed the average acne pit to be 1 mm. or less in depth, those considered as quite deep were about 2 mm., and only the very deep "ice pick" pits were deeper than 2 mm.

Microscopic examination of "ice pick" pits showed the extreme depth to which these scars can extend and the undermining or tunneling that can occur (Figure 7), although this may not be evident clinically.

Whether acne pits of average size and depth are removed completely or only partially at a given planing depends on the depth of the pit and the depth of the planing. Without excessively deep planing it may be impossible to entirely remove very deep pits with steep, narrow sides. This is a relative matter, depending not only on the depth of the pit but on its depth in relation to the total thickness of the dermis and its contained adnexa. For example, it may be possible to eliminate an "ice pick" scar on the thick skin of the medial or midcheek with safety, whereas the same depth of planing over the angle or ramus of the mandible or side of the neck could cause scarring due to complete destruction of the adnexa. Great care should be exercised to avoid excessively deep planing in the thin-skinned areas. This can best be done by not freezing to a board-like hardness in these areas and by planing lightly.

It has been our contention that planing of the face is not absolutely contraindicated in the case of a person of keloidal diathesis. This is borne out to a limited extent by the experience of one of us (Ayres), who has performed five full-face planings on three patients with pitted acne scars who had typical keloids elsewhere on the body (presternal area and arms). In each case a small test area was first planed on the face; then, no untoward reaction having occurred in six weeks, the full face was planed. One of the patients had very deep pits necessitating two deep planings. All three patients had an entirely satisfactory course over a period of many months of observation after planing.

2007 Wilshire Boulevard, Los Angeles 57 (Ayres).

REFERENCES

1. Beirne, G. A., and Beirne, C. A.: An attachment to the skin planing apparatus for the collection of abraded skin particles, *A.M.A. Arch. Derm.*, 73:70, Jan. 1956.
2. Burks, J. W.: *Wire Brush Surgery*. Published by Chas. C. Thomas, p. 79-80.
3. Eisen, A. Z., Holyoke, J. B., and Lobitz, W. C., Jr.: Responses of the superficial portion of the human pilosebaceous apparatus to controlled injury, *J. Invest. Dermat.*, 25:145-156, Sept. 1955.
4. Eller, J. J.: Developments in rotary abrasive technics for removing acne scars and other cosmetic defects, *New Eng. J. Med.*, 253:11-14, July 7, 1955.
5. Epstein, E.: Planing for precancerous skin, *A.M.A. Arch. Derm.*, 74:312-313, Sept. 1956.
6. Epstein, W., and Kligman, A. M.: The pathogenesis of milia and benign tumors of the skin, *J. Invest. Dermat.*, 26:1-9, Jan. 1956.
7. Hubler, W. R.: Comments on the technic of acne planing, *A.M.A. Arch. Dermat. & Syph.*, 70:513, 1954.
8. Kligman, A. M., and Strauss, J. S.: The formation of vellus hair follicles from human adult epidermis, *J. Invest. Dermat.*, 27:19-23, July 1956.
9. Luikart, R., II, Ayres, S., III, and Wilson, J. W.: Surgical Skin Planing—Dichlorotetrafluoroethane as the Refrigerant-Anesthetic; Scientific Exhibit Presented at Annual Meeting of American Academy of Dermat. & Syph., Chicago, Dec. 3-8, 1955.
10. Luikart R., II, Ayres, S., III, and Wilson, J. W.: Surgical planing of the skin—Dichlorotetrafluoroethane as a freezing agent, *Cal. Med.*, 84:151-154, March 1956.
11. Strauss, J. S., and Kligman, A. M.: Acne—Observations on dermabrasion and the anatomy of the acne pit, *A.M.A. Arch. Dermat.*, 74:397-404, Oct. 1956.
12. Wilson, J. W., Luikart, R., II, and Ayres, S., III: Dichlorotetrafluoroethane for surgical skin planing, *A.M.A. Arch. Dermat.*, 71:523, April 1955.
13. Wilson, J. W., Ayres, S., III, and Luikart, R., II: Mixtures of fluorinated hydrocarbons as refrigerant-anesthetic, *A.M.A. Arch. Dermat.*, 74:310-311, Sept. 1956.
14. Zimmerman, M.: Schock Letter, Dallas, Texas, Dec. 1956.

No. 1 Killer

The influence of fear as a deterrent to reckless driving seems to have been overrated, to judge by the comeback of cigarette sales after the lung cancer scare. But in Connecticut, where drivers lose their operator's license for 30 days for the first speeding conviction, fatalities were reduced 14 per cent. Governor Ribicoff said, "If people won't slow down to save their lives, they will to save their licenses."